## REMARKS

Claims 1-47 were presented for examination and are pending in this application. In an Official Action dated September 15, 2004, claims 1-47 were rejected. Applicants have amended claim 32 and cancelled claim 47. Applicants now request reconsideration and allowance of claims 1-46.

## Claim Rejections

Examiner has rejected Claims 32-40, and 47 under 35 U.S.C. 102(e) as being anticipated by Wilson. Specifically, regarding Claim 32, the Examiner has cited Wilson's disclosure of a video compression system comprising: [i] a processor-based platform coupled to a bus subsystem (Wilson: column 7, lines 1-20); and [ii] a front end subsystem having at least a motion estimation and compensation (MEC) engine (Wilson: column 21, lines 40-51) coupled to a stream buffer (Wilson: column 9, lines 40-54); as anticipating claim 32.

Applicants have amended claim 32, and submit that claim 32 as amended is not anticipated by Wilson. Claim 32 as amended recites a controller configured to "determine a preliminary motion vector from a set of partial motion vectors, each associated with a corresponding subsampled matchblock representing a given picture; generate a second motion vector based on a refined granularity of said preliminary motion vector; and perform a fractional pixel search using said second motion vector to produce a final motion vector, said final motion vector being used for motion compensation."

These aspects of the claimed invention provide for a novel motion estimation and compensation engine having three stages of motion vector determination, with successive stages having progressively refined granularity. In addition, these aspects provide for the use of subsampled matchblocks, advantageously enabling the determination of a motion vector with increased resolution while requiring less computation time versus conventional approaches.

These aspects of the claimed invention are not disclosed or suggested in Wilson, which teaches MPEG macro blocks and simple subsampling, but which fails to disclose or suggest preliminary motion vectors, partial motion vectors, or subsampled matchblocks. Furthermore, Wilson does not does not disclose or suggest second or final motion vectors, fractional pixel search, and final motion vectors for motion compensation, as now recited in the claim.

It is therefore respectfully submitted that the claim 32 is patentably distinct over Wilson. Applicants therefore respectfully request that Examiner allow Claim 32.

Claims 33-40 have also been rejected under 35 U.S.C. 102(e) as being anticipated by Wilson. The rejection of these claims is respectfully traversed. These claims depend directly or indirectly on claim 32, which Applicants submit is patentably distinguishable over the cited art. Claims 33-40 by definition include the limitations of claim 32 and recite additional patentable limitations that are distinguishable over the cited reference. For example, claims 33-40 include further limitations such as AxB arrays, MxN arrays of p_cells and other structures. Thus, Applicants submit that claims 33-40 are patentably distinguishable over the cited art, and respectfully requests that Examiner allow these claims.

Examiner has rejected claims 1-29 and 41-46 under 35 U. S.C. 103(a) as being unpatentable over Wilson in view of Masuda et al., (hereinafter referred to as "Masuda").

Regarding claims 1, 41 and 43, Examiner asserts that Wilson discloses a method of motion estimation and compensation processing (Wilson: column 21, lines 40-45), comprising: [i] determining a preliminary motion vector from a set of partial motion vectors each associated with a corresponding subsampled matchblock representing a given picture (Wilson: column 21, lines 47-49); [ii] generating a second motion vector based on a refined granularity of the preliminary motion vector (Wilson: column 21, lines 50-52), as in claim 1. Examiner further asserts that even though Wilson discloses refining a motion vector search, it fails to disclose [iii] performing a fractional

pixel search using the second motion vector to produce a final motion vector, the final motion vector being used for motion compensation, as in the claim. Examiner indicates that Masuda teaches [iii] by way of a two stage motion vector detection method (Masuda: column 12, lines 35-68; column 13, lines 1 - 10) wherein a final motion vector is generated using a fractional pixel search in order to predict an optimum prediction signal [that] can be obtained for a partial area whose movement is small (Masuda: column 14, lines 25-43). Examiner concludes that given this teaching, it would have been obvious for one of ordinary skill in the art to incorporate the Masuda teaching of a two stage fractional pixel precision motion vector detection into the Wilson method in order generate an optimum prediction signal for a partial area whose movement is small, and that the Wilson method, now incorporating Masuda's two stage fractional pixel precision motion vector detection, has all of the features of claim 1.

Applicants respectfully traverse the rejection of Claim 1. Claim 1 recites "determining a preliminary motion vector from a set of partial motion vectors each associated with a corresponding subsampled matchblock representing a given picture."

This aspect of the claimed invention provides for three stages of motion vector determination, with successive stages having refined granularity. In addition, these aspects provide for the use of subsampled matchblocks. These elements advantageously determine a motion vector with increased resolution while requiring less computation time versus conventional approaches. This in turn significantly reduces the time expended, and greatly increases visual quality.

Wilson does not disclose "determining a preliminary motion vector from a set of partial motion vectors each associated with a corresponding subsampled matchblock representing a given picture." Wilson's most closely related disclosure regards MPEG-oriented techniques wherein regions in two images are compared by taking the absolute differences between two sets of adjacent pixels (one set per image), and summing the differences to produce a single match score.

However, this fails to address determination of preliminary and partial motion vectors. Thus, it is respectfully submitted that claim 1 is patentably distinct over Wilson.

Similarly, Masuda, as presently understood, does not rectify this deficiency, as it does not disclose "determining a preliminary motion vector from a set of partial motion vectors each associated with a corresponding subsampled matchblock representing a given picture." Thus, it is respectfully submitted that claim 1 is patentably distinct over Masuda as well.

To establish a prima facie case of obviousness, three requirements must be satisfied. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Thirdly, the prior art reference(s) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicants' disclosure. MPEP 2142.

As discussed above, Applicants respectfully submit that the cited references fail to teach at least one element of Claim 1. Thus, Applicants submit that the third requirement for the prima facie case of obviousness has not been met, and thus claim 1 is patentably distinct over the cited art. Therefore, Applicants request that Examiner allow Claim 1.

The rejection of Claims 2-29 is respectfully traversed. Claims 2-29 depend from Claim 1, which Applicants submit is patentably distinct over the cited art. In addition, claims 2-29 recite additional patentable limitations that are distinguishable over the cited references. For example, claims 2-29 recite other patentably distinct steps such as dividing match blocks, dividing search arrays, using QxQ arrays of sub-pixels, calculating Psad, and enlarging search areas. Accordingly, Applicants request that Examiner allow claims 2-29 as well.

Similar arguments apply to Claims 41 and 43. Thus, applicants respectfully traverse these rejections and requests that these claims be allowed as well. Furthermore, since Claims 44-46 depend from Claim 43 and recite additional patentable limitations that are distinguishable over the cited references, Applicants request that Examiner allow claims 44-46 as well.

Regarding Claim 30, Examiner asserts that Wilson discloses a computer-implemented method (Wilson: column 7, lines 32-45) of motion estimation processing (Wilson: column 21, lines 40-45), comprising: [i] dividing a matchblock of a current frame into a plurality of sub-matchblocks (Wilson: column 21, lines 53-59, the current frame to be encoded (Wilson: column 7, lines 43-45); [ii] dividing a first search area of a reference frame into a plurality of search sub-blocks (Wilson: column 21, lines 40-41); [iii] replicating a sub-matchblock over each of the search sub-blocks (Wilson: column 21, lines 43-45); [iv] performing partial pixel level searching in parallel (Wilson: column 23, lines 25-31) of each sub-matchblock replicated over the search sub-blocks to generate a preliminary motion vector (Wilson: column 21, lines 49-5 1); [v] modifying the first search area to produce a second search area (Wilson: column 2 1, lines 49-5 1); [vi] performing full pixel level searching of the matchblock over the second search area to generate a second motion vector (Wilson: column 21, lines 49-51), as in claim 30.

Applicants hereby traverse the rejection.

Claim 30 recites "dividing a matchblock of a current frame into a plurality of sub-matchblocks, the current frame to be encoded; [and] dividing a first search area of a reference frame into a plurality of search sub-blocks." These aspects of the claimed invention comprise aspects of the determination of a preliminary motion vector. Such determination advantageously expedites the development of subsequent, higher-resolution motion vectors.

Applicant disagrees with Examiner's characterization of Wilson. Wilson refers to the MPEG algorithm generally, and to the related concept of macro blocks, i.e., 16x16 pixel regions

used for motion estimation. However, Wilson does not disclose dividing a matchblock of a current frame into a plurality of sub-matchblocks, the current frame to be encoded; [and] dividing a first search area of a reference frame into a plurality of search sub-blocks. Likewise, Masuda, as currently understood, does not disclose these elements. Masuda discloses the ordering of blocks according to activity, but again does not disclose dividing a matchblock of a current frame into a plurality of sub-matchblocks, the current frame to be encoded; [and] dividing a first search area of a reference frame into a plurality of search sub-blocks.

Claim 30 also recites "replicating a sub-matchblock over each of the search sub-blocks; [and] performing partial pixel level searching in parallel of each sub-matchblock replicated over the search sub-blocks to generate a preliminary motion vector."

Wilson again refers generally to comparing pixels in two regions, but does not teach replication of a sub-matchblock of a current frame over each of the search sub-blocks of a reference frame. Also, Wilson does not disclose generating a preliminary motion vector by performing partial pixel level searching in parallel of each sub(sampled)-matchblock replicated over the search sub-blocks. Although Wilson discusses subsampling, it does not disclose doing so over a plurality of sub-matchblocks in parallel. Furthermore, Masuda, as presently understood, does not disclose these elements. Masuda discloses a circuit for dividing a video signal into a plurality of blocks. However, Masuda does not disclose replication of a sub-matchblock of a current frame over each of the search sub-blocks of a reference frame; neither does Masuda disclose performing partial pixel level searching in parallel of each sub(sampled)-matchblock replicated over the search sub-blocks.

As discussed above, Applicants respectfully submit that the cited references fail to teach several elements of Claim 30. Applicants therefore respectfully submit that the third requirement

for the prima facie case of obviousness has not been met, and thus claim 30 is patentably distinct over the cited art. Therefore, applicants request that Examiner allow Claim 30.

Similar arguments apply to Claim 42. Thus, applicants therefore respectfully traverse the rejection of claim 42 and respectfully requests that this claim be allowed as well.

Claim 31 depends from Claim 30, which applicants submit is patentably distinct over the cited art. In addition, claim 31 recites additional patentable limitations such as determining residual data and prediction that are distinguishable over the cited references. Accordingly, Applicants request that Examiner allow claim 30 as well.

In view of the foregoing arguments, Applicants respectfully submit that the claims presently in this case are now in condition for allowance. Reconsideration and prompt favorable action are therefore solicited.

Respectfully submitted,
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